

WHAT IS CLAIMED IS:

1. A method for estimating the error statistic for retrieved temperature and emissivity of a surface material, comprising:
 - 5 determining the second order analytical error propagation for surface temperature and emissivity of a surface material;
retrieving surface temperature and emissivity from a sufficiently large ensemble of radiance spectra by Monte Carlo simulation; and
determining the error in retrieved surface temperature and emissivity arising
 - 10 from random instrument noise from analytical error propagation and/or Monte Carlo simulation.
2. The method for estimating the error statistic as in Claim 1, wherein determining the second order analytical error propagation comprises determining the
15 covariance and bias surface temperature and emissivity errors retrieved utilizing an ISSTES algorithm.
3. The method for estimating the error statistic as in Claim 1, wherein retrieving surface temperature and emissivity by Monte Carlo simulation comprises
20 generating an unbiased ensemble of measurement errors for the covariance of the measured variables.
4. The method for estimating the error statistic as in Claim 3, wherein retrieving surface temperature by Monte Carlo simulation comprises adding errors to
25 produce an ensemble simulating the results of making the same measurement many times.
5. The method for estimating the error statistic as in Claim 4, wherein retrieving surface temperature by Monte Carlo simulation further comprises
30 evaluating an ensemble of measurement utilizing the function $F(X)$ to generate an ensemble of dependent variables.

6. The method for estimating the error statistic as in Claim 5, wherein retrieving surface temperature by Monte Carlo simulation further comprises estimating the mean, bias and variance of dependent variables.

5 7. The method for estimating the error statistic as in Claim 6, wherein retrieving surface temperature by Monte Carlo simulation further comprises retrieving surface temperature and emissivity for each spectrum in an ensemble.

10 8. The method for estimating the error statistic as in Claim 1, wherein determining the second-order analytical error propagation comprises translating a radiance error of a surface material into a diagonal covariance matrix.